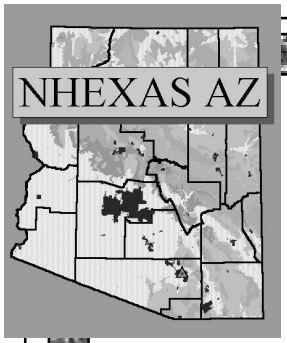
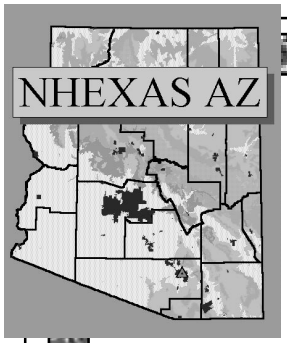


NHEXAS Arizona
Arizona Border Survey Overview



NHEXAS Arizona & The Arizona Border Survey

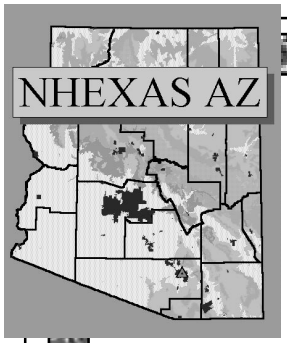
Michael D. Lebowitz P.I.

Co-Principal Investigators

Mary Kay O'Rourke, Arizona

Sydney M. Gordon, Battelle

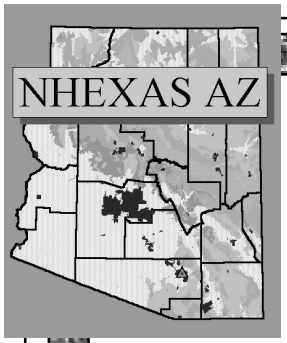
Demetrios Moschandreas, IIT



Overarching Vision and Goal

Vision: To select a representative population and obtain all the measurements needed to perform complete exposure assessment, and to enhance the quality of policy formulation with appropriate use of the survey results.

Primary Goal: To define the high end (upper 10^{th} percentile) of the exposure distribution for the population.

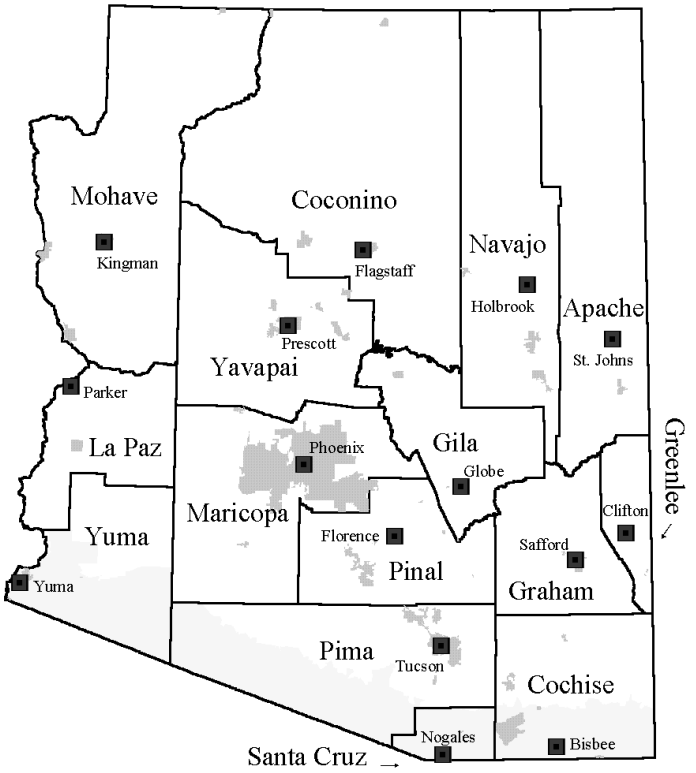


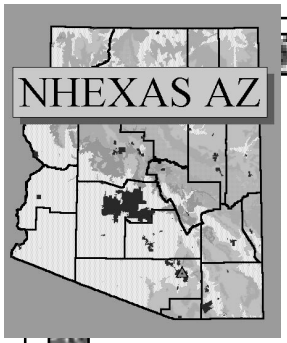
NHEXAS AZ & BORDER AZ

NHEXAS AZ & BORDER EXTENSION

University of Arizona : Battelle Columbus : Illinois Institute of Technology: CDC and FDA

Interactive Agencies: ADEQ, ADHS, County Boards of Health





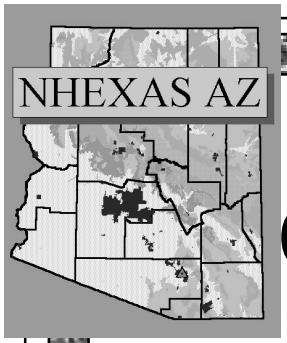
Objectives & Hypotheses: NHEXAS AZ

(1) To document the occurrence, distributions and determinants of exposure.

(2) To evaluate geographic and temporal trends.

- exposures detrimental to public health do not occur
- temporal trends do not vary
- there are no differences among different geographic areas

(3) To evaluate the impact on exposure models of using less precise concentration measurements.



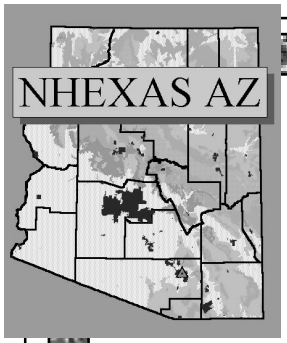
Objectives & Hypotheses: NHEXAS AZ

(4) To evaluate exposure as indicated using biomarkers.

(5) To link “exposure-dose-health” information to enhance, surveillance, risk assessment, risk management and public health policies.

(6) To compare iterative exposure assessment models (various levels of complexity) and assess the impact of the EA models on risk assessments.

(7) Evaluate model uncertainties.

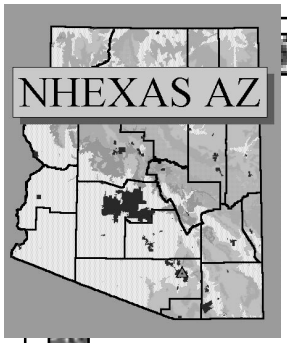


Objectives & Hypotheses: NHEXAS AZ

(8) to collaborate on pharmacokenetic modeling.

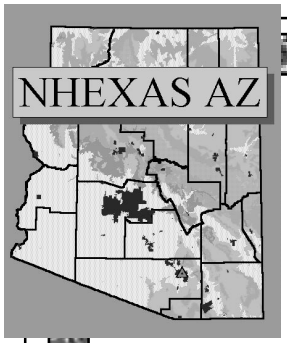
(9) To evaluate exposures of sub-populations by modeling.

- Issues of Stratification and Detection



Objectives & Hypotheses: Border

- The distribution of exposure for the population residing in the “Border” region does/does not differ from that of the State .
- The intermedia analyte relationships do/do not differ between the Border and the rest of the State.
  - Compare AZ Border media means with LRGV border results



Target Analytes

NHEXAS-- PM_{10}

Metals: Pb, As, Ni, Cd, Cr, Mn, Ba, V, Se, Zn (+17)

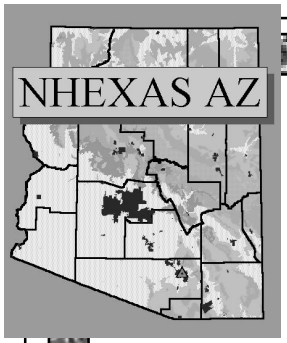
Pesticides: Chlorpyrifos, Diazinon, Malathion

VOCs: Benzene, Toluene, 1,3 butadiene, TCE , Formaldehyde (+39)

Border -- NHEXAS Analytes plus $PM_{2.5}$

Additional Pesticides--OCs

PAHs

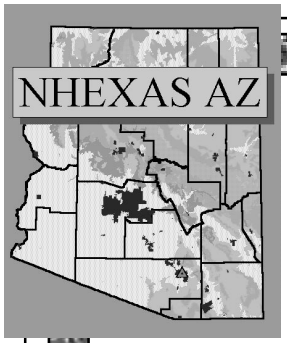


Study Design: NHEXAS & Border

- Recruitment: Population Proportional to Size

  probability of selection is proportional to the number of occupied housing units in the 1990 census.

- Multiple Media & Multiple Pathways
  - Air, Water, Soil, Dust, Wipes
  - Food (Solid & Liquid)
  - Biologicals (Blood, Urine)
  - Questionnaires, including Time-Activity Diaries



Recruitment Strata

NHEXAS AZ

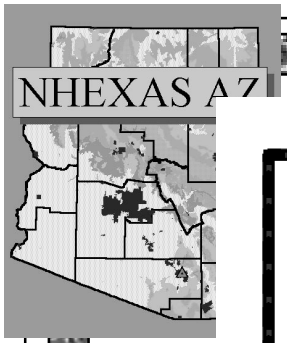
- Areas = 14/15 Counties
- PSUs = 49 Census Tracts
- SSUs= 245 Block Combos (5 per tract)
- Houses = 5 houses per block

3-4 Stage 3's per PSU

AZ Border Survey

- Areas = 3/4 Counties
- PSUs = 25Census Tracts
- SSUs= 100 Block Combos (4 per tract)
- Houses = 3 houses per block

4 Stage 3's per PSU



NHEXAS AZ Primary Sampling Units

N

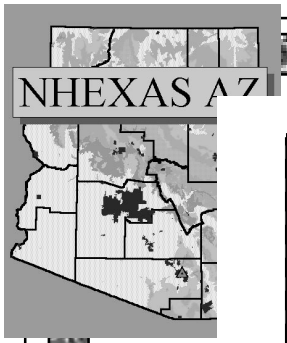
Urbanized Areas

County Boundaries

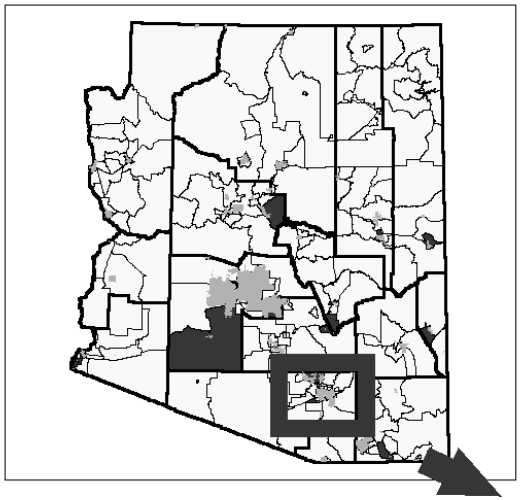
1990 Census Tracts

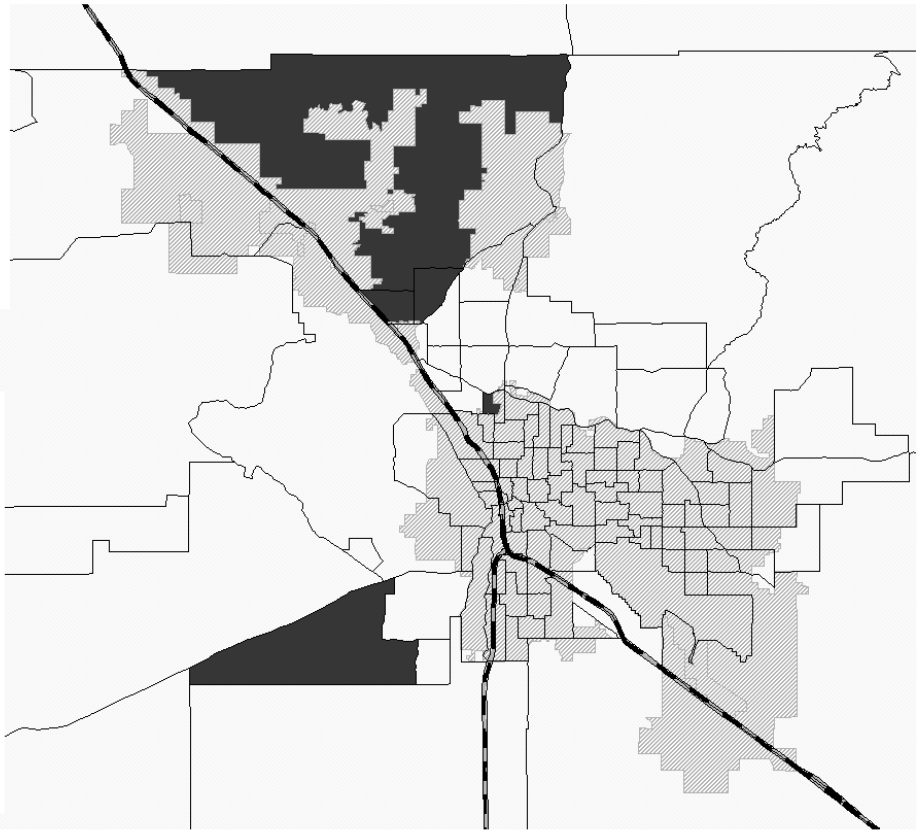
Selected

Not Selected



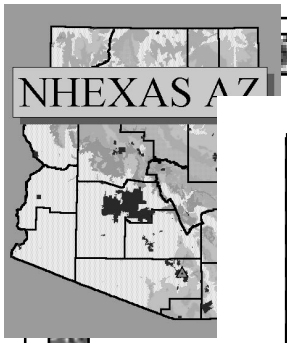
Primary Sampling Units
Tucson Metro. Area



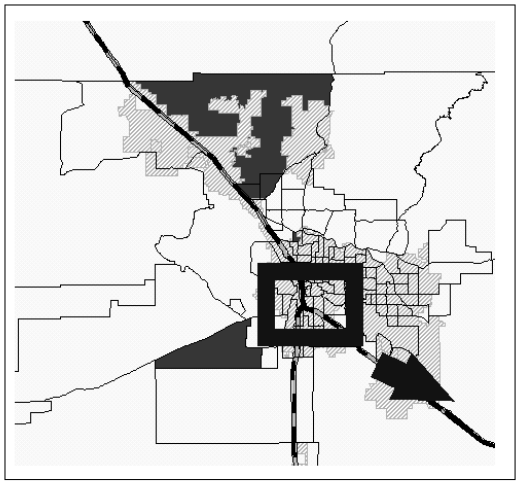


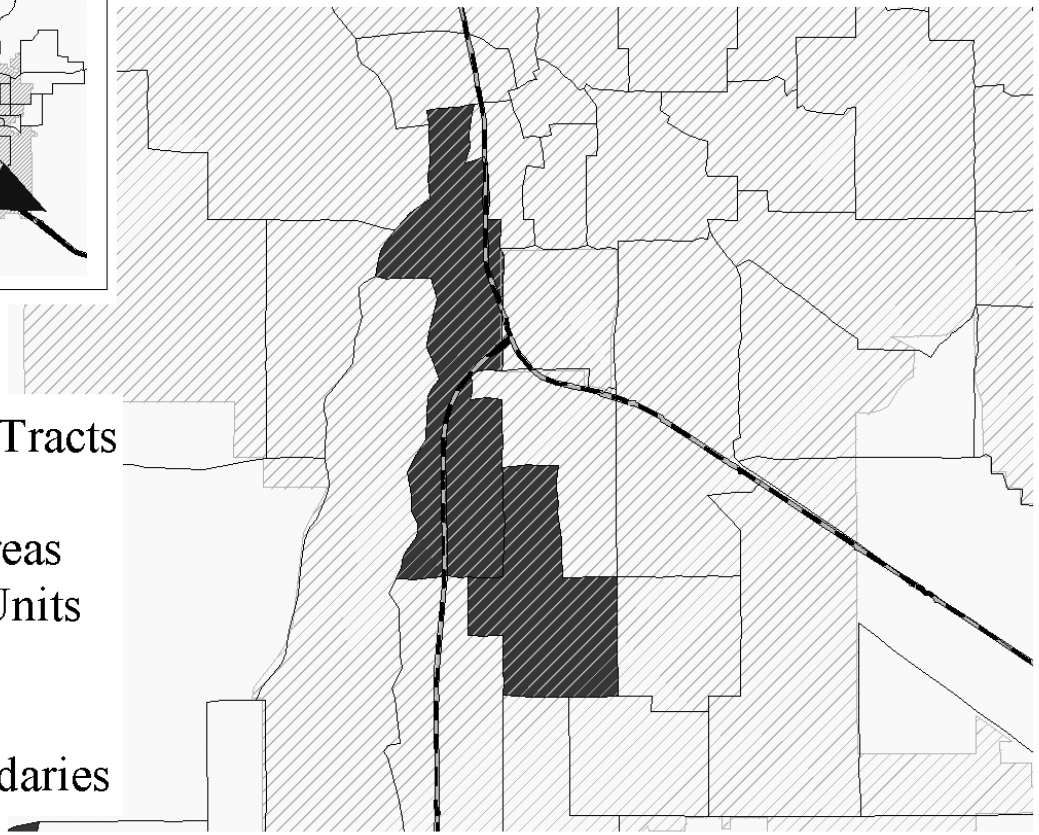
1990 Census Tracts
Azinterstate
Urbanized Areas

Primary Sampling Units
Selected
Not Selected
County Boundaries



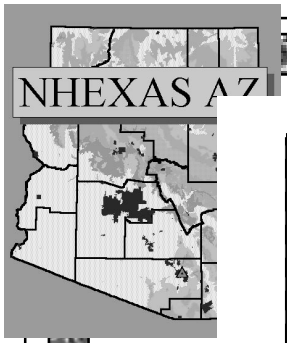
Primary Sampling Units South Tucson, AZ.





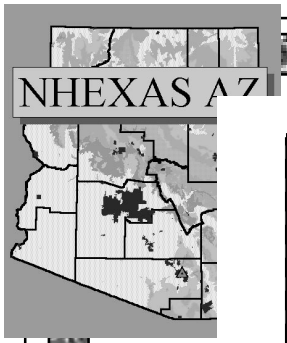
1990 Census Tracts
Azinterstate
Urbanized Areas

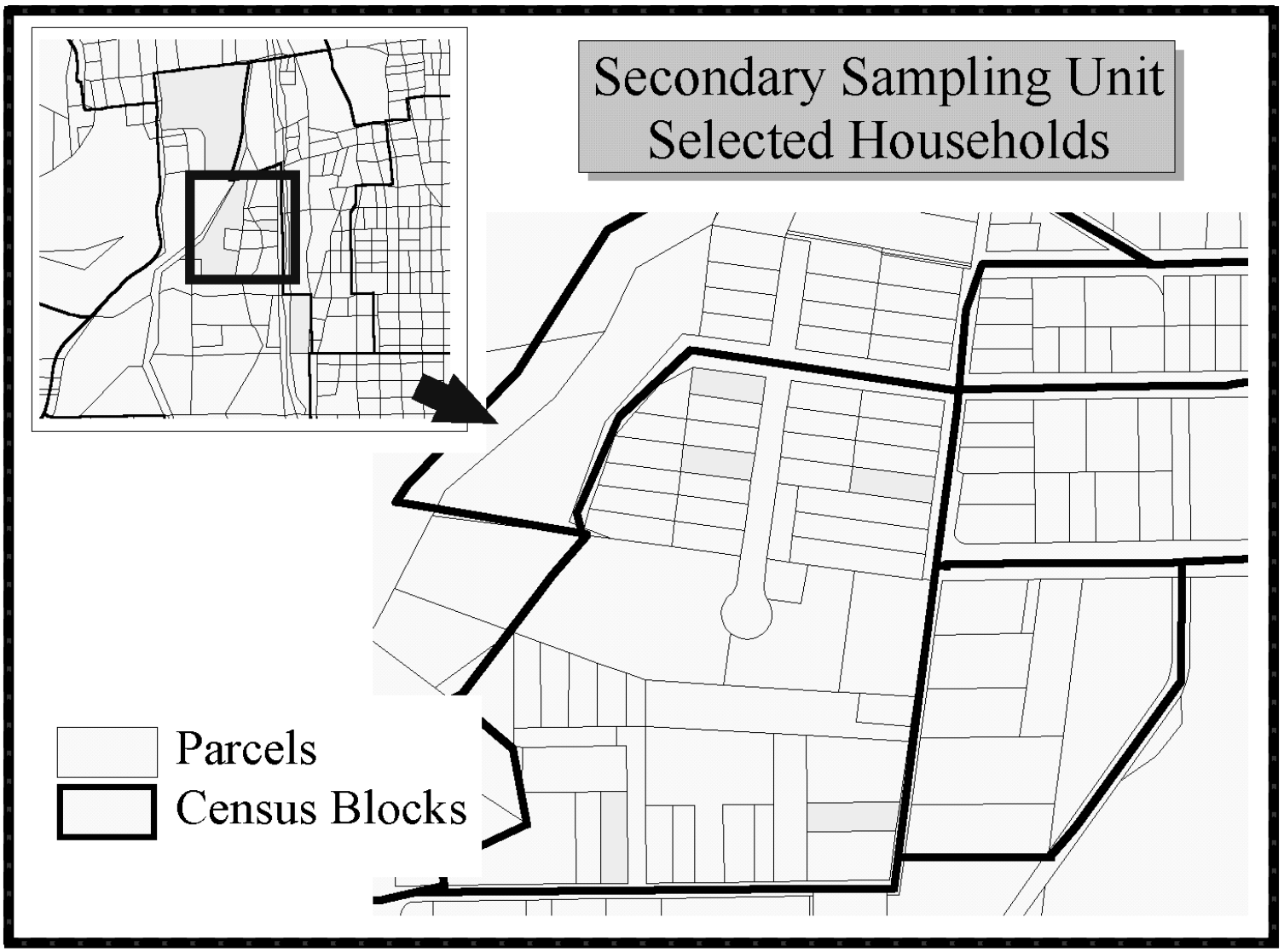
Primary Sampling Units
Selected
Not Selected
County Boundaries

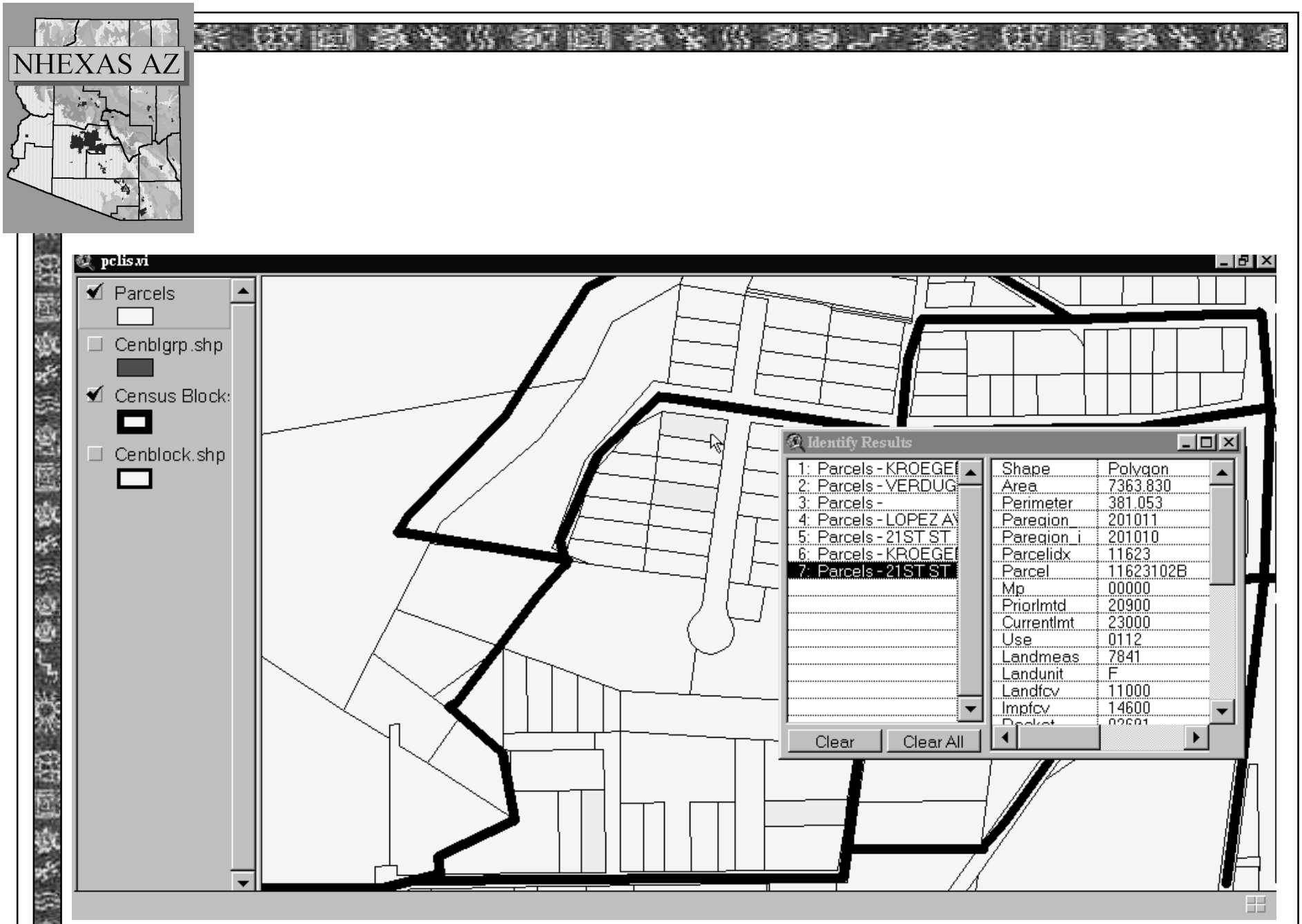


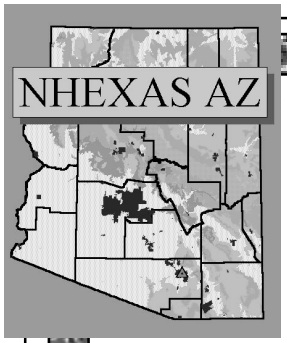
Secondary Sampling Units
City of Tucson

1990 Census Blocks
Selected SSU
Not Selected
Azinterstate
1990 Census Tracts
Selected PSU
Not Selected


NHEXAS AZ

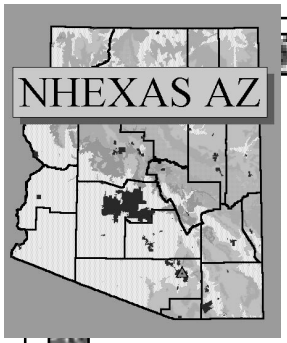

Secondary Sampling Unit
Selected Households
Parcels
Census Blocks


NHEXAS AZ
pclis.vi
Parcels
Cenblgrp.shp
Census Block
Cenblock.shp
Identify Results
1: Parcels - KROEGE
2: Parcels - VERDUG
3: Parcels -
4: Parcels - LOPEZ A
5: Parcels - 21ST ST
6: Parcels - KROEGE
7: Parcels - 21ST ST
Shape
Polygon
Area
7363.830
Perimeter
381.053
Paregion_
201011
Paregion_i
201010
Parcelidx
11623
Parcel
11623102B
Mp
00000
Priorlmtd
20900
Currentlmt
23000
Use
0112
Landmeas
7841
Landunit
F
Landfcv
11000
Impfcv
14600
Clear
Clear All



Study Design

- Three Phase Design:
  - Stage I NHEXAS = 1225 Border = 300
    Rate 77.9% ~87.6%
    Descriptive Baseline Questionnaires.
  - Stage II NHEXAS = 391 Border = ~91
    Questionnaires, Food & Activity Diaries &
    Collection of Screening Data & Samples.
  - Stage III NHEXAS = 179 Border = 86
    Intensive Environmental Sampling, Biomarkers, Water
    Duplicate Diet & Questionnaires.

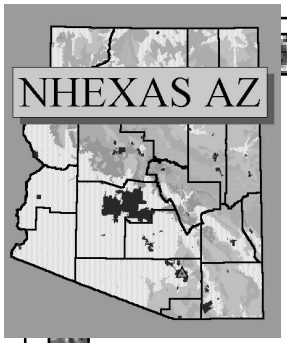


Stage 1: Recruitment

- During early recruitment, homes were contacted up to 15 times with no success
- Negligible recruitment occurred after 5 attempts.
- Procedure of NHEXAS AZ & Border

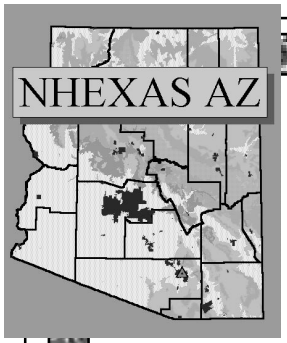
  Weekday, Weekend day, Weekday evening, Weekend evening, one other attempt

- Virtually NO ONE would complete a 27 page (1 hr) Baseline QX unscheduled.



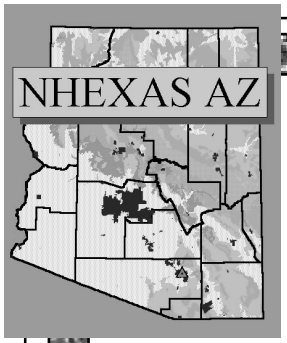
NHEXAS Demographics: Race/Ethnicity

	White	Black	America Indian	Asian	Other	Hispanic	No Response
% 1990 Census	81.0*	3.0	5.6	1.4	9.0*	18.6	
% 1996 Census Estimate	88.9	2.97	4.99	1.75	NA	21.26	
% Total NHEXAS	92.5	2.1	3.5	0.5	1.2	41.8	0.2
% Primary Stage I	93.3	1.9	2.8	0.5	1.4	35.2	0.1
% Primary Stage II	93.7	1.6	2.2	0.6	2.0	30.1	0.0
% Primary Stage III	91.7	1.7	2.8	0.6	3.3	30.0	0.0



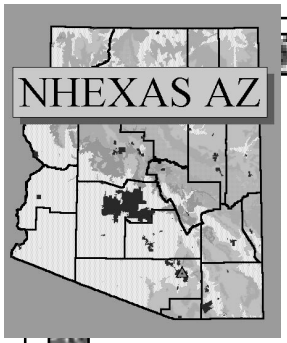
Demographic Characteristics of Stage III NHEXAS Participants

	Percent	Number
Age Group		
6-17	19.5%	35
18-65	65.4%	117
>65	15.1%	27
Hispanic Ethnicity		
Yes	29.6%	53
No	70.4%	126
Smoking		
Yes	18.9%	34
No	81.1%	145



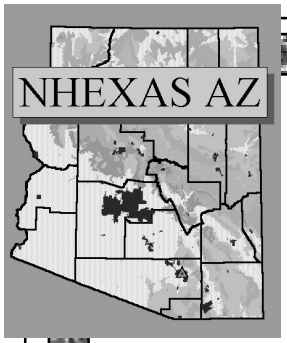
NHEXAS & Border AZ Essentials

- Multiethnic, multigender Field Teams
- Bilingual Field Teams
- All materials in Spanish and English
  - NHEXAS:
    - 25 % preferred Spanish
    - 4% completed Questionnaires in Spanish
  - Border:
    - ~ 75% preferred Spanish
    - ~50% completed Questionnaires in Spanish



Stages 2 & 3: Sampling

- Randomize homes and recruit for Stage 2 & 3 sampling.
- If selected for Stage 3 sampling then collect Stage 2 samples at the same time.
- If sampling is refused, try to obtain a Baseline Questionnaire



Stage 2 (n=125)

Questionnaires:

Descriptive Update
Baseline
Diet Diary*
Time / Activity*
Technician
Supplement

* One day recall

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7

Sample Collection:

Yard Soil
Floor Dust

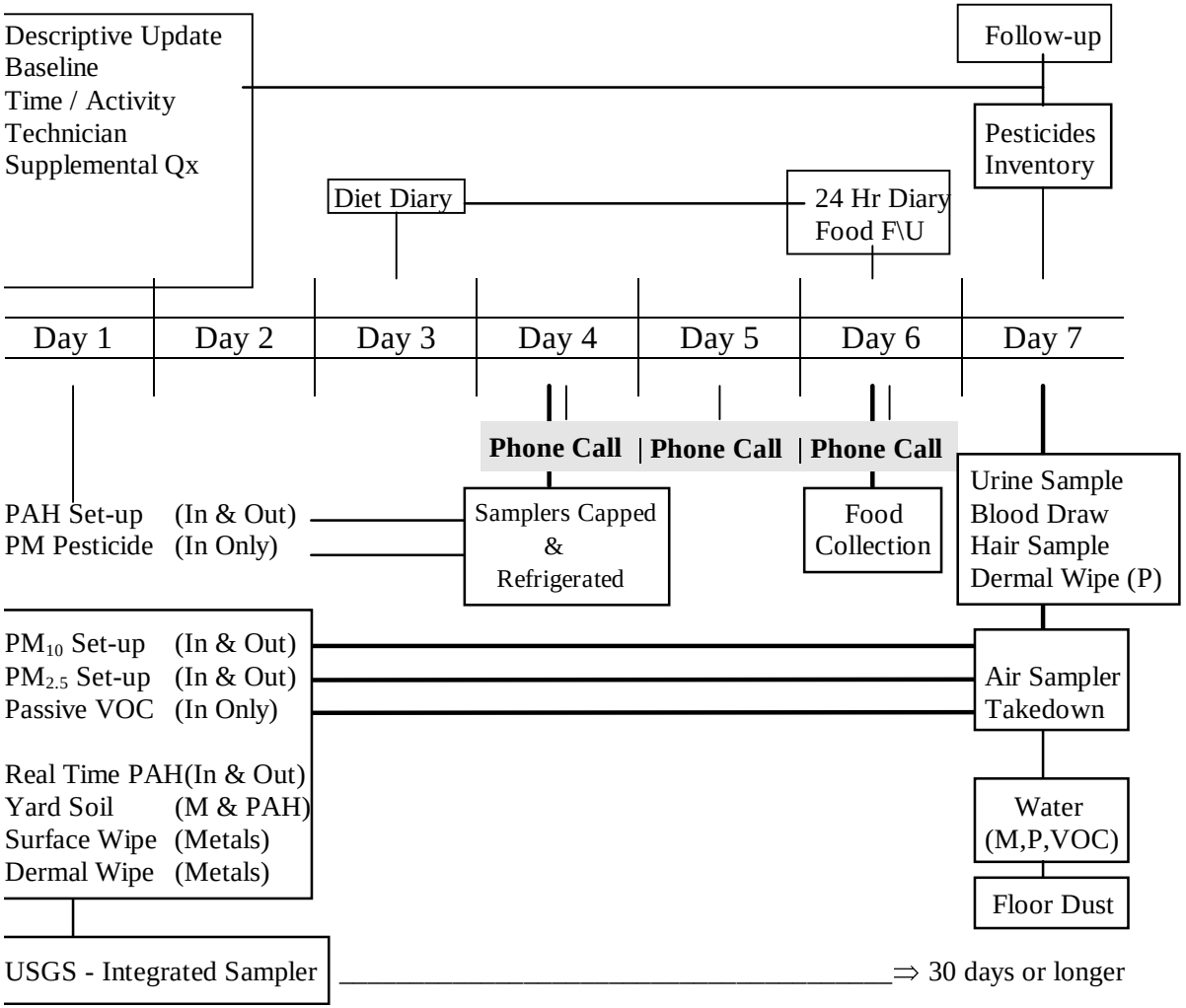
NHEXAS AZ

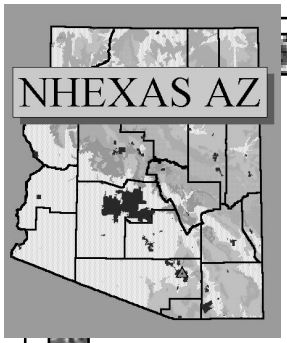
Sample Collection: Relative Timing

Stage 3 (n=86)

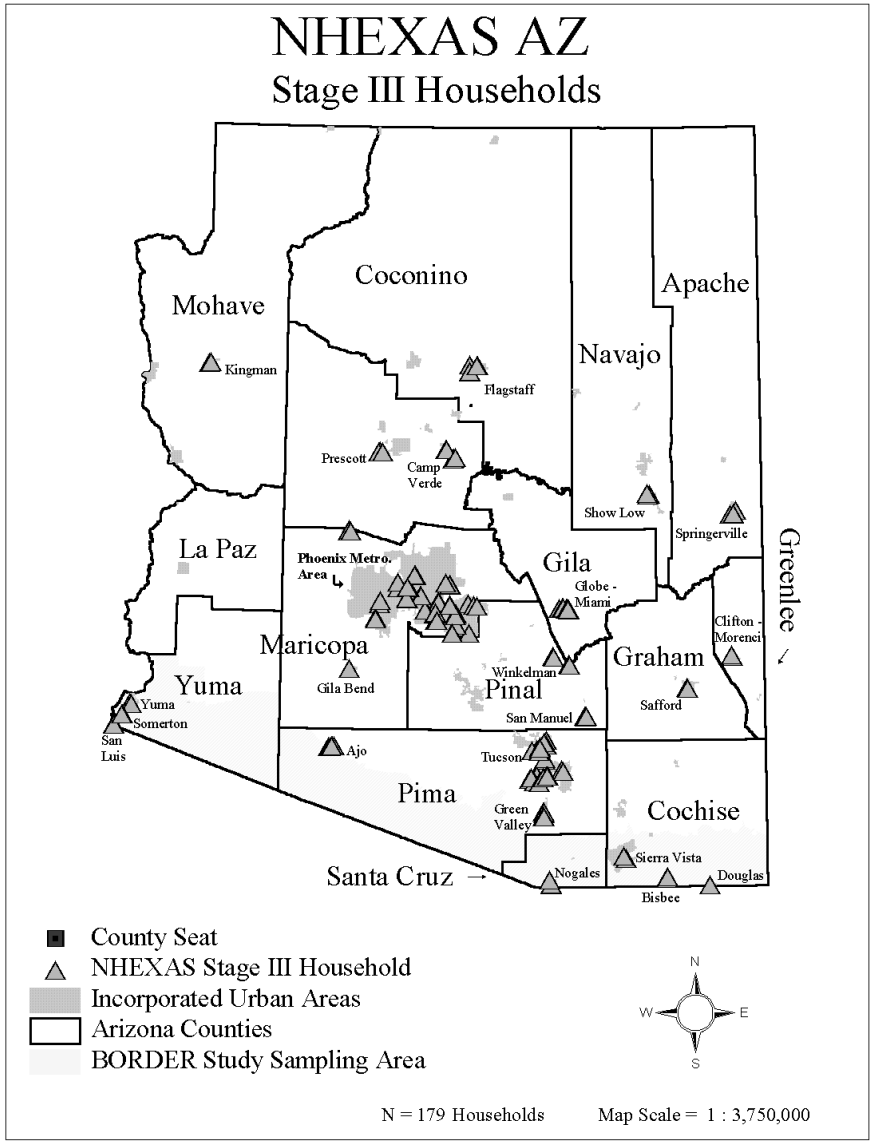
Two Visit Scenario

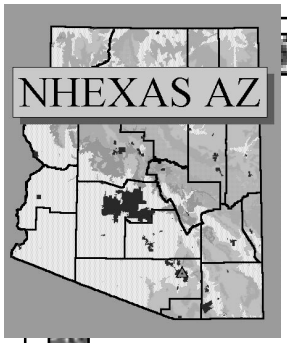
Questionnaires:





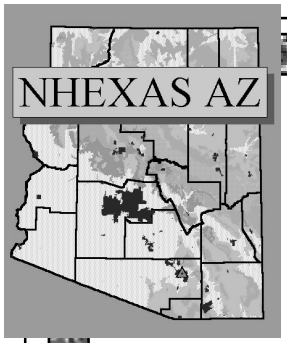
NHEXAS AZ Stage III Households





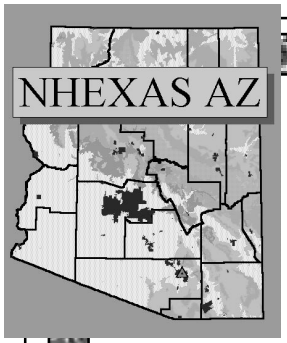
Households Completed

	NHEXAS	AZ Border
# HH (IRN 01)	955/1225 (78%)	263/300 (88%)
# People (D Qx)	3205	~833
# Baselines (IRN 01)	525	169
# Secondary Baseline Qx	564	~157
#HH Stage 2 only	212	5
# HH Stage 2 + 3	179	86



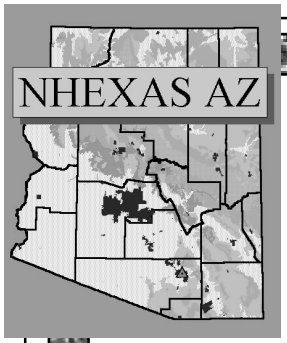
NHEXAS Field and Lab Methods

	Field	Lab
Air		
PM_{10} In & Out	Pump & Teflo Filter 3 of 7 days.	HGAAS (As) ICP, XRF
PM_{10} Personal Air	Pump & Teflo Filter 8 of 24 hrs.	
House Dust		
Vacuum Floor	In-line filter, sieve to 62.5µm.	HGAAS (As) ICP, XRF
Window Sill Wipe	Gauze & DiDw wipe.	
Soil		
Yard	Composite, sieve to 62.5µm.	HGAAS (As) ICP, XRF
Foundation	Composite, sieve to 62.5µm.	
Food		
Solid & Beverage	24 hr. Duplicate sample.	ICP-MS by FDA
Water		
Tap	3 min flush (EPA 200.8).	ICP-MS
Drinking	Standing sample(EPA 200.8).	ICP-MS
Dermal Wipe		
Both Hands	Gauze wipe, DiDw x 2 mins.	GCMS
Blood		
(Pb & Cd only)	10 mL Venipuncture	GFAAS by CDC
Urine		
	First Morning Void	HGFAA (As) GFAAS



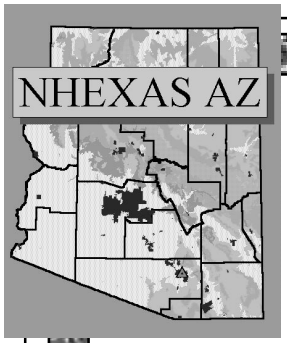
NHEXAS Detection Limits

- see overheads



NHEXAS Distribution of As Concentration by Media

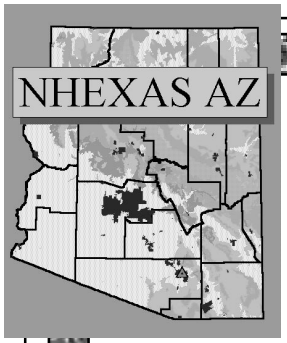
Media	Metal	Detection method	Number of samples evaluated	% of samples BDL	Range of values above MDL	Percentile		
						50th	75th	90th
Air—In	As	HG-AAS	125	71	2.9-22.3	BDL	3.5	7.4
Air—Out	As	HG-AAS	116	68	3.1-24.5	BDL	5.3	8.9
Dust	As	HG-AAS	131	0	0.3-50.6	6.7	10.4	16.5
Soil	As	HG-AAS	143	0	1.8-69.3	8.3	12.5	19.2
Food	As	ICP-MS	159	0.6	2.3-2878.0	9.0	15.1	30.6
Beverage	As	ICP-MS	154	30	1.0-19.9	1.9	3.8	6.8
Drinking Water Consumed	As	ICP-MS	73	59	0.2-15.9	BDL	2.9	6.5
Tap Water Consumed	As	ICP-MS	82	0	0.6-36.7	4.7	9.1	15.1



Potential As Dose µg/day

Mining towns (n=43 subjects)

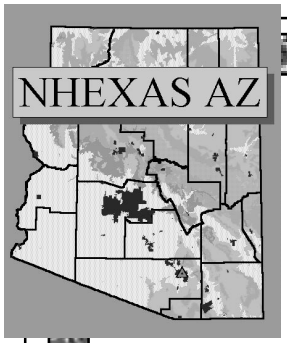
	25th	50th	75th	90th
◆ Dust	2.1	2.8	4.0	5.7
◆ Soil	.5	.8	1.2	1.6
◆ Water	.7	3.3	12.2	15.2
◆ Food	4.5	6.1	9.4	22.6
◆ Beverage	1.5	2.5	7.0	16.6
◆ Total	14.6	20.6	35.8	69.2



Potential As Dose µg/day

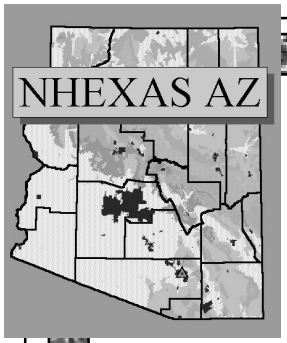
Non Mining towns (n=122 subjects)

	25th	50th	75th	90th
◆ Dust	1.5	2.0	2.3	3.4
◆ Soil	.3	.5	0.8	1.4
◆ Water	.5	2.6	4.2	8.1
◆ Food	3.2	5.5	10.3	22.0
◆ Beverage	.7	1.8	3.8	6.7
◆ Total	11.6	15.6	23.5	33.6



Conclusions

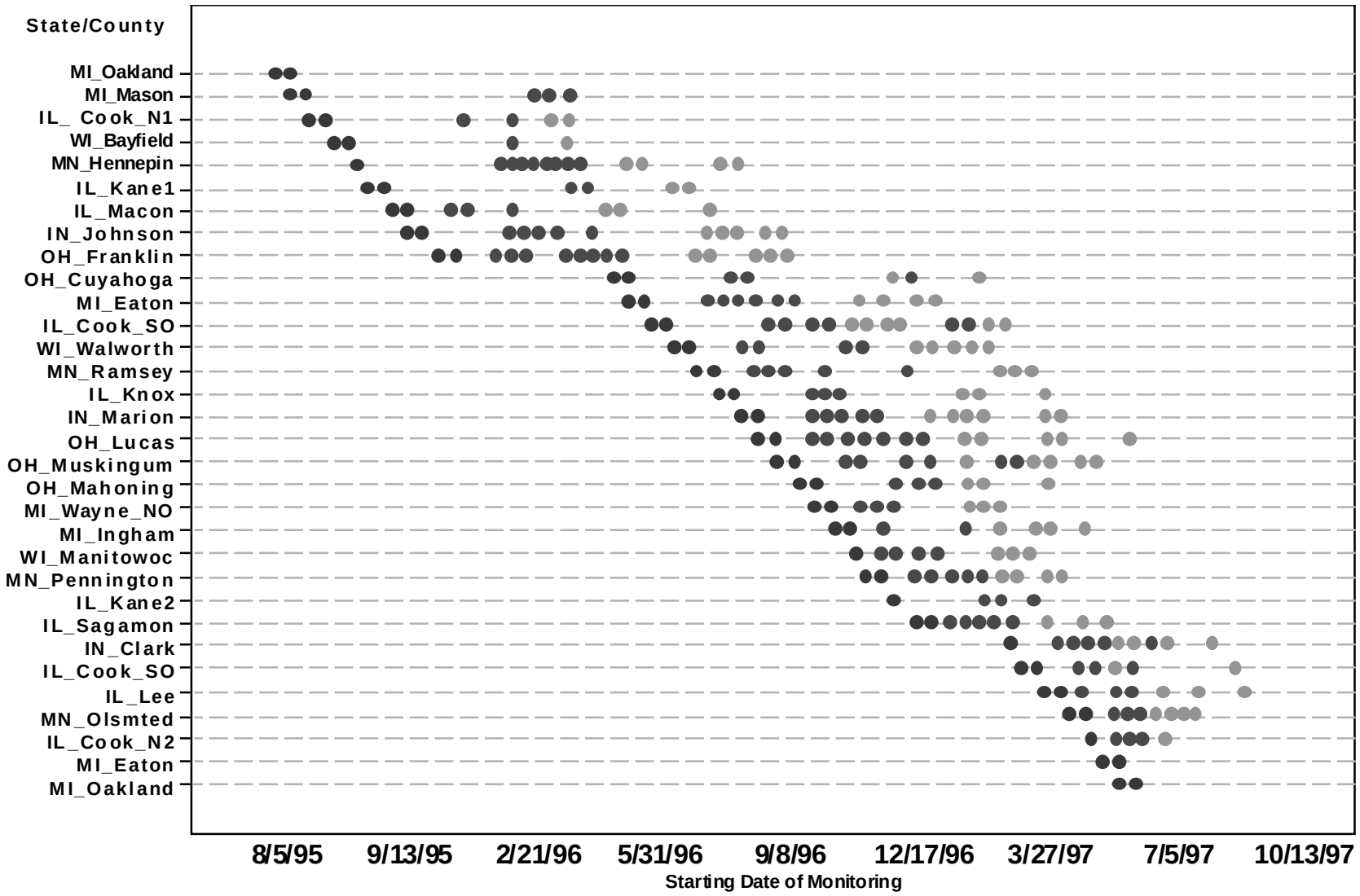
- The last example illustrates the power of these data to identify total exposure during the sample week.
- The As data demonstrates a geographic difference in exposure.
- We are in the final stages of compiling the Border data bases. No work has been done on these data.



Conclusions

- The percentage of samples with BDL values are very high for many analytes.
- Still, NHEXAS and affiliated surveys provide rich sources of data for examination.

Data Collection Schedule



Scan1a.fh3